MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

PDS0101 – INTRODUCTION TO DIGITAL SYSTEMS

(All sections / Groups)

13 October 2016
9.00 am - 11.00 am
(2 Hours)

INSTRUCTIONS TO STUDENTS

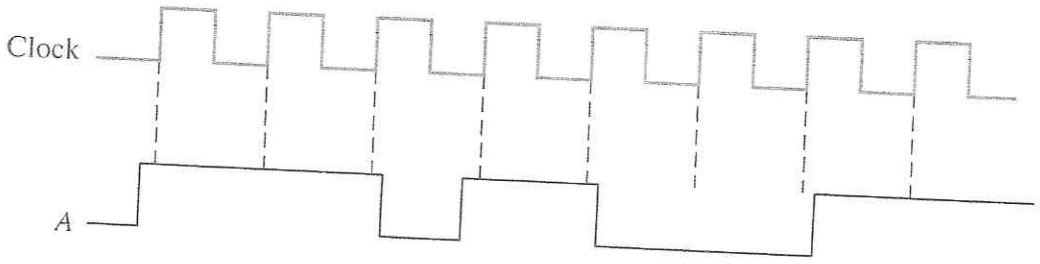
1. This Question paper consists of 10 pages with 5 Questions excluding cover page. Please attempt **ALL** questions.
2. The total marks for this paper is 50 marks and the distribution of the marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

QUESTION 1

a) Referring to the square waveform A shown in the image below, answer the questions that follow.

[4 Marks]



i. Determine whether the waveform A is periodic or non-periodic. State your reason.
ii. Indicate the sequence of bits transferred if a bit is read upon the clock's rising edge.
iii. What is the time required to send one (1) bit if given the reference clock is running at 200KHz?
iv. Calculate the total time required the send the bits you determined in (ii).

b) Calculate $(A3)_{16} + (1000)_2$ and give your answer in octal base 8. **[3 Marks]**

Continued ...

c) Perform the calculation of $(6C)_{16} - (77)_8$ using 8-bits signed 2's complement binary numbers and give your answer in decimal. **[3 Marks]**

QUESTION 2

a) Prove that A+A'B=A+B by using Boolean algebra rules. **[3 Marks]**

Continued ...

b) It is given that X=AC (A+B). Find the output of X for the following truth table.

[3 Marks]

A	B	C	A+B	AC	X
0	0	0			
0	0	1			
0	1	0			
0	1	1			
1	0	0			
1	0	1			
1	1	0			
1	1	1			

c) By applying Boolean rules and theorems, simplify the given expression X, and list all the logic gates for the simplified X.

[4 Marks]

X= AB'C'+ABC'+ABC

Continued ...

QUESTION 3

a) Derive the Boolean expression of W in standard Sum of Products (SOP) format for the given truth table. **[3 Marks]**

Input			Output
A	B	C	W
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

b) Apply K-map to minimize the Boolean expression into SOP form.

[3 Marks]

Continued ...

c) Construct a truth table for the Boolean expression T. By applying Boolean rules and theorems, simplify the given expression T. **[4 Marks]**

$$T = [ABC\ (BC)']'$$

Continued ...

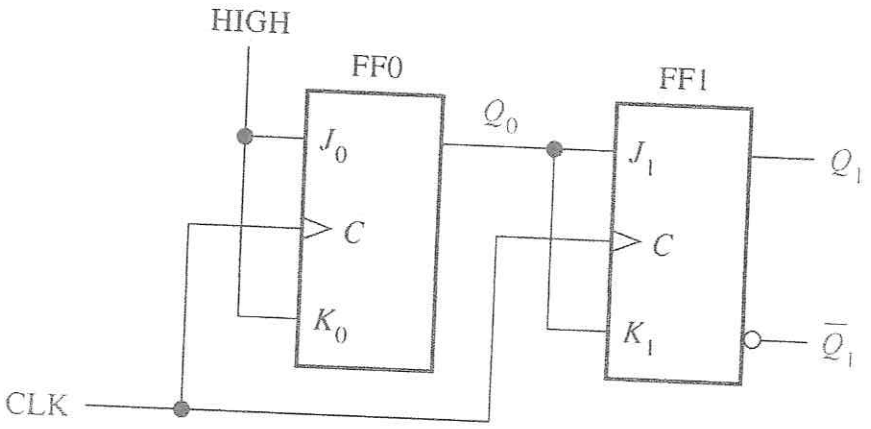
QUESTION 4

a) Design a 2-bit parallel adder block diagram by using a half adder and a full adders, where carry output is represented by C_{out} and sum of each bit adder is represented by $\sum_1$, $\sum_2$ and $\sum_3$.

[3 marks]

b) For a positive edge triggered J-K flip-flop with inputs as shown below, determine the Q_0 and Q_1 output relative to the CLK assuming that Q_0 and Q_1 are initially LOW for the FOUR clock pulses.

[3 Marks]



Continued ...

c) Draw the logic circuit diagram for a 4-bit parallel in/parallel out shift register.

[4 Marks]

Continued ...

QUESTION 5

Design a 3-bit synchronous gray code counter using JK flip-flops that count from 000, 001, 011, 010, 110, 111, 101, 100 and repeats.

a) Construct the state diagram for the needed counter. **[2 Marks]**
b) Create the next state transition table according to the state diagram in (a). **[2 Marks]**
c) Define the J and K inputs for each flip-flop involved in the counter. **[2 Marks]**
d) Perform K-map simplification for each of the flip-flops in the counter. **[2 Marks]**
e) Implement the final expressions as combinational logic with flip-flops to complete the design of the counter. **[2 Marks]**

a) state diagram

b) Next state transition table is created based on the state diagram

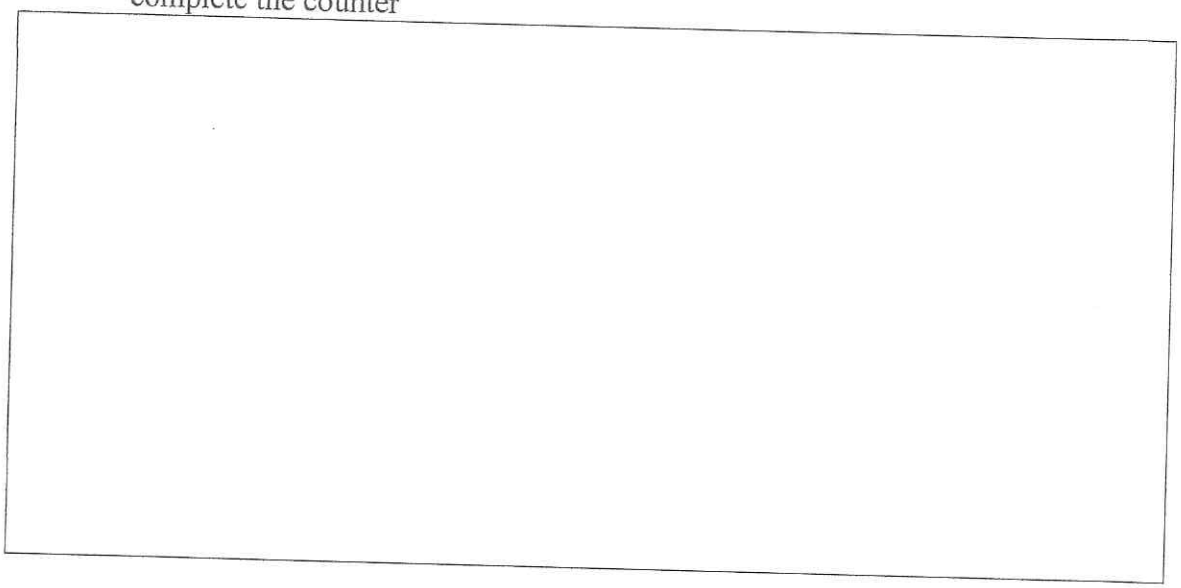
Continued ...

c) Define J and K inputs for each FF involved in the counter

d) Perform K-map simplification for each of the FFs in the counter

Continued ...

e) Implementation of the final expressions as combinational logic with FFs to complete the counter



End of Exam